AMRAD NEWSLETTER

Amateur Radio Research and Development Corporation

October 1982

AMRAD October Meeting

On Monday, October 4, 1982, we will meet to hear Hal Feinstein, WB3KDU discuss error detection in digital communications systems. The meeting will be at 7:30 P.M. at the Patrick Henry Branch Library, 101 Maple Ave East, Vienna, Virginia.

AMSAT Annual Meeting

The AMSAT annual meeting will be on Sunday, October 10 at the Goddard Employee's Recreation Center. If you would like to be there for dinner, please be sure to reserve a space by contacting AMSAT. You can call the AMSAT office on 301-589-6062 or try to catch Tom Clark, W3IWI on the AMSAT fm repeater on 146.835/.235 MHz a few days ahead of time. At the annual meeting, a report will be made on the development of Phase III-B packet radio standards.

AMRAD CBBS Bouncing Back

Those of you who check into the AMRAD computerized bulletin board system (CBBS) on 703-734-1387 have noticed that it has been hors de combat for a while. That has been due to disk-drive problems. As this is being written, the drives are back from repair, and the system should be back on line by the time you read this. In addition to operating the CBBS, Terry Fox, WB4JFI also operates a duplex packet repeater, WB4JFI/R, via the AMRAD WD4IWG/R 2-meter fm repeater. That has been on and off for the past month or so, also due to technical problems. Terry advises that sooner or later everything in his shack will be work again.

AMRAD Library Demobilized

Unfortunately, we were underwhelmed by volunteers to take over the job of librarian from Tedd Riggs, KC4YN. Tedd was forced to evict the library because he needed the space. We were unable to locate anyone who had the space to accept it. The crisis was dimishished to some extent by some ruthless on-the-spot decisions. What remained (many QST, 73, Ham Radio magazines, Teletype manuals, and some other items) was taken away in Bill Pala's truck. Bill is interested in merging the QSTs with his collection to make a fairly complete set. Terry Fox agreed to take the early Byte magazines to complete his set. However, we would like to find a home for the balance, particularly the 73s. If you know of a good home for them, please give Bill a call on 703-323-8345.

Membership Renewal

Please take a look at your mailing label to see when your AMRAD membership expires. If it is about to expire, the computer will insert the words "PLEASE RENEW" on the label. If you have been paying dues on an annual basis up 'til now, you may wish to take advantage of our life membership status which is open only until the end of 1982. Check the application blank inside the back page of this newsletter for rates.

If you are changing addresses, please send us an application blank with your new information a month before you move. The Post Office does not forward Third Class mail.

FCC Approves Additional Digital Codes

Printed in this newsletter is the full text of the FCC's report and order on PR Docket 81-699. It provides for the use of any digital code above 50 MHz and increases the ASCII/digital keying speeds greatly. We are particularly pleased to see that our request for 56 kilobaud/100 kHz bandwidth in the 220-meter band was approved. Thanks to the ARRL and FCC for a nice job of modernizing the rules.

President Reagan Signs P.L. 97-259

This will be known as "PL-259" within the amateur community. It was called S. 929 (or the Goldwater Bill) and H.R. 5008 along the way. The new law will do a number of things for us that were not provided in the original Communications Act of 1934... some revolutionary things. The ARRL is now getting geared up to take over the testing of applicants for Amateur Radio licenses. The FCC has new authority to set RFI susceptibility standards. Volunteers can be used by the FCC. Amateurs can operate a self-policing program without conflicting with communications privacy provisions of the original law. Keep an eye on QST magazine for details.

IEEE/LIMARC Network Reactivates

On Wednesday, October 13 at 8:30 P.M. Eastern Daylight Time, the IEEE/LIMARC Net organized by Ed Piller, W2KPQ, will start a new season. The featured speaker will be Homer Huddleston, W5TLW. Homer's talk is on video teleconferencing, including new video codecs that compress a full-motion video signal to 1.544 Mb/s. We are planning to carry the talk over the AMRAD repeater. Amateurs on participating repeaters are encouraged to ask questions or contribute to the discussion.

N5AHD Sends Packets through AMSAT OSCAR 8

Robert J. Diersing, N5AHD successfully passed a packet through OSCAR 8 on September 1, 1982 at 0110 UTC, orbit number 22887, Mode J, with a transceiver using nbfm modulation. On September 6, 1400 UTC, orbit 22938, Mode J, several more successful tests were made, this time using the transceiver in ssb mode. The successful tests were sent and received at N5AHD using VADCG TNC boards and Bell 202 type 1200-baud modems. These followed several unsuccessful tests tried with W3IWI. More tests are planned. Congratulations.

ARRL Virginia State Convention

On Saturday and Sunday, October 9 and 10, the Computer Show and Hamfest sponsored by Tidewater Radio Conventions will be held in the Pavillion in Virginia Beach, VA. Talk-in is 146.19/.79 MHz.

Packet Repeater in Rochester, NY

Ray Williams, WA2RYT has a packet repeater ready to go on 146.46 MHz simplex and is looking for other packeteers in the area to get some activity going. He has a VADCG TNC board, AMRAD-provided repeater software, an ICOM IC-22S transceiver and Ringo Ranger antenna. Ray's address is 305 Barry Rd, Rochester, NY 14617.

SPREAD SPECTRUM

Hal Feinstein, WB3KDU
1410 Rhodes St. North
Arlington, VA 22209
703-524-9116 home

Next month Paul Rinaldo, W4RI and Hal Feinstein, WB3KDU will be giving a paper at the IEEE/AFCEA Military Communications Conference (MILCOM'82) in Boston on October 17-20. A look at the conference agenda reveals that almost the entire conference is dedicated to military uses of spread spectrum. The AMRAD paper is part of a session on civilian uses of spread spectrum.

Recently I was able to talk to Walter Scales of Mitre Corporation who has done some important studies in spread spectrum. I understand that Mitre is currently working on a design study for a distress system which will use direct-sequence spread spectrum and transmit the distress calls to the MARSAT maritime mobile satellite. Spread spectrum is being used because of its anti-jam properties. It seems that distress channels are in heavy use for things other than distress calls (such as a calling channel). The danger is of course that the ground stations would not hear a distress call employing standard modulation techniques when the channels are busy. Spread spectrum is expected to get through, because it is spread over 100 kHz, and its current design calls for keying in the user position. MARSAT is operated by a consortium of countries. The MARSAT system has attracted many ship users and has taken a lot of ship-to-shore traffic off the hf bands.

Exploding a Myth

Can frequency-hopped (FH) spread spectrum be received without knowing the code? The answer is almost always "yes." If you ask if FH can be received on a conventional ham receiver, the answer is almost always "no." The difference lies in the fact that FH is constantly changing frequency. It does so at a rate of many times a second. But something that doesn't change is the position of the spread-spectrum station.

The key to detecting FH is to use a wideband receiver which will encompass the hopping bandwidth and then point a very directional antenna at the FH station. Antennas have become very complicated in this day and age. For example, some are electronically steerable, and the reception pattern is electronically shaped to null out jamming and interference. For ham radio applications, a good yagi array will do nicely in most cases until such time that a band gets crowded with spread-spectrum signals.

The military has known all about the wideband-receiver/sharp-beam antenna trick and has gone to some trouble to see that their messages are protected. One system has several different FH transmitters set up at one location and rotates the data between each transmitter. When a transmitter doesn't have data, it is transmitting stuff that looks like valid data. Attempts to separate the individual signals will be difficult because the signals are coming from the same place.

Spread Spectrum Legal?

On September 14, the FCC passed rule changes which will permit digital codes other than Baudot and ASCII for digital communications above 50 MHz. The new rules will allow speeds up to 56 kb/s or bandwidths up to 100 kHz above 220 MHz, for example. Suppose that a slow data signal is being generated at the rate of 1 kb/s. Next let us make a pseudo-random code sequence by generating ASCII characters at the rate of 50 kb/s. Every six nonsense characters or so, one of the information characters is inserted into the stream. What do we have?

Because the stream is made up of a pseudo-random stream of characters, we should expect the spectral density to look much like our sin x/x curve. This is the spectral shape that we want. Inserting a "deterministic" character every once in a while (by strict schedule known to all) should alter the spectral shape only a little. Food for thought?

Shift-Register Update

Every shift register has an equation which describes its actions. It turns out that if you are given the shift register equation you can always find the sequence that it generates by long division. To find the sequence, you merely need to find the reciprocal of the shift-register equation.

Suppose that you want to find the shift-register sequency for a shift register with the equation 1 + x + x^2 (in the last term, ^2 is used to indicate the second power). Notice that if this is a maximal-length generator, we should expect the sequence to repeat after 2(3) - 1 or 7 terms. Let's now take the reciprocal.

```
                                                    1+x+x^3+x^4+x^6+x^7
                                                  ---------------------
1+x+x^2/1
        1+x+x^2
        -------
          x+x^2
          x+x^2+x^3
          ---------
                x^3
                x^3+x^4+x^5
                -----------
                    x^4+x^5
                    x^4+x^5+x^6
                    -----------
                          x^6
                          x^6+x^7+x^8
                          -----------
                              x^7+x^8+x^9
                              x^7+x^8+x^9
                              -----------
                                      0
```

The answer to this long division is:

1+x+(0*x^2)+x^3+x^4+(0*x^5)+x^6+x^7

This means that the shift-register output is:

11011011

Notice that we are doing division a little different from the normal method. The main fact is that subtraction and division are the same. Why? Because we are doing all arithmetic modulo 2. In this system subtraction produces the same result as addition.

```
1 + 1 = 0
1 + 0 = 1   Modulo 2 addition is the same as
0 + 1 = 1     exclusive-OR.
0 + 0 = 0
```

Before the Federal Communications Commission
Washington, D. C. 20554

PR
FCC 82-413
32009

In the Matter of	)	
	)	PR Docket No. 81-699
Use of Additional Digital Codes	)	RM-3788
in the Amateur Radio Service.	)	

REPORT AND ORDER
(Proceeding Terminated)

Adopted: September 14, 1982 Released: September 21, 1982

By the Commission

1. On October 1, 1981 the Commission adopted a Notice of Proposed Rule Making 1/ in the above-captioned matter proposing to allow amateur radio stations to use digital codes, other than those specified by the Commission, on amateur radio frequencies above 50 MHz. That Notice was in response to a petition for rule making, RM-3788 submitted by the American Radio Relay League, Incorporated (ARRL), which seeks amendment of the Amateur Radio Service Rules (Part 97) to provide for the use of any digital encoding technique in the amateur radio frequency bands above 50 MHz. Currently, the Rules only permit the use of the International Telegraphic Alphabet Number 2 (Baudot code) and the American Standard Code for Information Interchange (ASCII code). The comment period for the Notice ended January 15, 1982 and the reply comment period ended February 15, 1982.

2. In its Notice of Proposed Rule Making, the Commission specifically proposed to permit the transmission of digital codes, other than those defined in the Rules, on all amateur radio frequencies above 50 MHz, with the exception of those frequencies designated for A1 emissions only (50.0 - 50.1 MHz and 144.0 - 144.1 MHz). It was also proposed to limit communications using such codes to those between points within areas regulated by the FCC (domestic operation). Requirements that a station licensee include a description of the unspecified digital code in the station records and that the licensee, upon direction of the Commission, cease or restrict the use of the code, or maintain a record of coded communications, were also included in the proposal. In related areas, the Notice proposed to raise the maximum sending speed for ASCII coded communications from 1200 baud to approximately 19.6 kilobaud on amateur radio frequencies between 50 and 225 MHz; but it was also proposed to specify this higher speed, as well as all other sending speeds, in terms of "bits per second." The proposal included bandwidth specifications for transmissions of ASCII coded communications between 50 and 225 MHz, and for all transmissions of communications using unspecified digital codes. Finally, the Commission proposed to allow the use of A1 emissions for the transmission of ASCII coded communications on frequencies between 3.5 and 28 MHz.

3. Virtually all of the comments on the Notice support the Commission's proposal, however many suggest minor modifications. John A. Carroll, in his comments, quotes the following portion of the Commission's Notice: "We believe that other unspecified digital coding techniques may also lend themselves to digital voice, facsimile, and television communications. As such uses are not currently prohibited by the rules, the Commission does not see a need to restrict these uses for the unspecified digital codes." John A. Carroll's comment goes on to state that certain of these uses have "... enormous potential for improved communication, especially relay communication...." and that "... it would be well to add a few extra words (to the final rules) so that there is no doubt about (this) intent." Since the Commission desires to set forth the rules in the clearest possible manner and also desires to foster experimentation in the Amateur Radio Service, we are including such additional language in the final rules.

4. With regard to our proposal that communications using unspecified digital codes be limited to domestic operation only, the ARRL, petitioner in RM-3788, states in its comments, "There is at present a great deal of interest in linking together packet repeaters between Canada and the United States. The League would suggest that the final rules for additional digital codes provide that, should the governments of, for example, Canada and the United States specifically so agree, VHF or UHF digital communications across national borders shall be permitted." The Commission recognizes the potential desirability of such intercommunication and accordingly the final rules have been fashioned in such a way as to not preclude the use of unspecified digital codes across borders of consenting countries.

5. Several commenters express concern that the proposed rules allowing the Engineers-in-Charge (EICs) of field facilities to restrict the use of unspecified digital codes, or require maintenance of a record of the communications, might be imposed indiscriminately or without due consideration of the burden involved. The comments of the ARRL state, "While the need for this available sanction is manifest ... the practicality of compliance with such a sanction is of some concern. Conversion of a digitized image or voice transmission or the contents of a computer memory into plain language may be difficult to accomplish." The ARRL also expresses concern that "... the potential requirement that an amateur maintain a record ... of all coded transmissions from the station with which communication is established may be burdensome in certain cases." John A. Carroll's comments state that "... high speed digital communication could rapidly generate a large amount of communicated information, which, by Amateur standards, would be prohibitively costly to file." His comments also state that "(t)his is not to suggest that the provision shouldn't be there; (it would be) an important contribution to effective enforcement ... (but) it would be desirable to indicate how this authority is intended to be used."

1/ 46 FR 50993, October 16, 1981.

6. The Commission is sympathetic to these concerns and we are including language in the final rules which states that the authority being granted to the EICs to limit unspecified coding, or require maintenance of a record, may only be invoked when "... necessary ... to assure compliance with the rules...." We are also deleting from the final rules the proposal that the EICs be authorized to require the recording of communications from a station with which communications are established using unspecified digital codes.

7. Also with regard to the authority the Commission proposed granting the EICs, the comments of Paul Newland state, "The proposal ... is well reasoned and more than fair ... (however it) doesn't include any recourse for the amateur who has been directed to cease (unspecifically coded) transmissions permanently. I would like to see a hearing (or some other process) as a next step in resolving ... a shut-down order." In fact, the appeal process which applies to virtually all Commission actions will also apply to this delegation of authority to the EICs. An amateur operator aggrieved by invocation of that authority may file an application for review or a petition for reconsideration of the action. 2/

8. The sentiment of the comments is unanimously against the Commission's proposal to replace the term "baud" in the rules limiting sending speeds, with the term "bits per second." Representative of this sentiment are the comments of Robert J. Carpenter which state, "If two bits are coded into a single time element (four level coding) the number of 'bits per second' is twice the number of 'bauds,' but the bandwidth occupied has not increased. I feel certain that the Commission intends to control the characteristic which relates to occupied bandwidth (bauds)...." Indeed, the Commission's interest is in maintaining spectrum efficiency through limitations on bandwidth. And since we do not want to close off "... a prime area of legitimate technical interest and experimentation by amateurs ..." 3/ we are going to continue to specify maximum sending speeds with the term "baud" so that amateur operators can utilize multi-level coding without incurring a sending speed penalty. We are adding a sending speed definition to the rules to make the Commission's intent in this area clear.

9. Several comments express a desire for the Commission to allow sending speeds greater than those proposed in the Notice for ASCII coded communications in the VHF 4/ and higher frequency bands. Those comments also request a commensurate increase in the bandwidth authorized for unspecified digital codes. The comments of Paul Newland suggest that techniques such as "Time-Division Multiplex (TDM)" could be used so that "... more users could benefit by allowing digital transmissions to occupy a bandwidth greater than the Commission had initially planned to allocate." The Amateur Radio Research and Development Corporation (AMRAD) states in its comments that "(t)he highest permissible ASCII sending speed and bandwidth should be raised to 56 kilobits per second and 100 kHz respectively in the 220.5 to 221.9 MHz subband to

2/ See Section 1.106 and 1.115 of the Commission's Rules; also Section 5, paragraph (d)(4), and Section 405 of the Communications Act of 1934, as amended.

3/ Comments of the American Radio Relay League, Incorporated.

4/ The Very High Frequencies (VHF) are those between 30 and 300 MHz.

permit packet switching network operations in that subband." The reply comments of the ARRL state, "The League shares the concerns of Messrs. Rinaldo (for AMRAD) and Newland, and suggests that the Commission increase permissible bandwidths for digital transmissions at and above 220 MHz."

10. The Commission appreciates the desire of the amateur community to experiment and operate with state-of-the-art digital technology. Therefore, in order to avoid hampering these endeavors we are authorizing greater ASCII sending speeds and the use of wider bandwidths for unspecified coded transmissions. We are authorizing a sending speed as great as 56 kilobaud and a bandwidth as great as 100 kHz in accordance with the request of AMRAD; however, in order to permit the greatest flexibility in spectrum utilization, we are going to permit this speed and bandwidth on all frequencies above 220 MHz rather than limiting them to the frequencies between 220.5 and 221.9 MHz. Furthermore, the final rules will allow the use of any bandwidth on frequencies above 1215 MHz rather than imposing a limitation as was proposed in the Notice. The Commission is also not adopting the bandwidth restriction proposed for transmissions of ASCII coded communications on frequencies between 50 and 225 MHz, using sending speeds between 1200 and 19600 bits per second. Instead we will allow a maximum sending speed on the frequencies between 50 and 220 MHz of 19.6 kilobaud without a bandwidth restriction. The maximum speed of 56 kilobaud will apply to the frequencies between 220 and 225 MHz as discussed earlier. We are raising the permissible bandwidth for transmissions of unspecifically coded communications between 50 and 220 MHz from 16 kHz to 20 kHz in order to fit more closely our desire to equate these emissions with the ones currently used in those bands.

11. The Commission is also including some other minor changes in the final rules regarding sending speed and bandwidth. We are revising our bandwidth definition to eliminate certain ambiguities in the definition we proposed in the Notice. We wish to emphasize that this definition does not imply, nor do we intend to require, that amateur radio operators continuously monitor their emission bandwidth while using the digital codes which subject the station transmissions to bandwidth limitations. We only require that operators comply with the bandwidth requirements. Operators may determine compliance through electronic, mathematical or any other means they deem sufficient. We are also eliminating the requirement that stations using the Baudot code maintain the sending speed within certain tolerances. Currently, the sending speed must be maintained within 5 words per minute of the standard speeds (60, 67, 75 or 100 words per minute). However, that requirement no longer serves any regulatory purpose since electronic rather than electro-mechanical teleprinter equipment is now commonly used and the newer equipment is less sensitive to variations in sending speed.

12. As another minor change, the Commission is authorizing the use of A1 emissions for ASCII coded communications on all frequencies where F1 emissions are permitted. We had proposed to limit the use of A1 emissions for ASCII coding to the frequencies below 28 MHz, however we can find no reason not to permit this additional mode in the bands above 28 MHz as well. A small amendment to the rules regarding operator privileges is being added to preclude the use of ASCII coded communications by Novice class and Technician class operators using frequencies below 28.2 MHz. This represents no change in privileges for these operators.

13. Finally, with regard to the authorization of unspecified digital codes, concern was expressed in the Commission's Notice that such an authorization could affect "... our ability to monitor coded transmissions for content, as well as the ability of the amateur community to monitor transmissions from individual stations for the purpose of self-enforcement." In response to this concern the comments of the ARRL state the following:

> The League is sympathetic to, and generally shares the Commission's reservations about any reduction in the Commission's ability to monitor coded transmissions for content, or the amateur's ability to monitor for purposes of self-enforcement. A combination of several factors should be sufficient to minimize the potential for abuse, however. First, the primarily local nature of communications on the VHF and UHF frequencies involved should limit the potential ability of unscrupulous business users to utilize the amateur bands to transmit data of a commercial nature, circumventing existing common carriers. Second, the vigor with which amateurs protect their allocated frequency bands against unauthorized interlopers, together with well-polished direction finding techniques, will in most cases result in investigation by amateurs of the source of repeated unusual or suspicious digital transmissions. The requirement of open identification procedures is a significant litmus for distinguishing legitimate amateur use from unlawful misuse of amateur frequencies. Finally, the provisions of proposed Rules Section 97.69(c)(3) permit the Commission to take immediate action against a station suspected of unlawful misuse of the amateur bands via unspecified digital codes by ordering the cessation of the use of such codes. The above factors, together with the traditionally superlative level of rule compliance by amateurs, should be sufficient to offset the League's concern and that of the Commission with respect to potential misuse of digital codes.

We have considered this matter at great length. In balancing our objectives of encouraging new technologies against assuring our enforcement capability, it must be recognized that there is an incompatibility between authorizing experimentation with "exotic" technologies and the employment of channel monitoring as an enforcement tool. Our ability to verify that the content of messages complies with our rule requirements will be hindered by the broad relaxation of regulatory constraints that we are ordering in this proceeding. However, the Commission finds itself in agreement with the ARRL that special provisions we are including in the final rules, as well as existing provisions that identification be made in plain English or the international Morse code, should, when combined with the zealous effort of the amateur community to protect their allocated frequency bands, provide adequate protection against unauthorized operation in the service.

14. Accordingly, IT IS ORDERED that effective October 28, 1982, Part 97 of the Commission's Rules and Regulations, 47 CFR Part 97, IS AMENDED as set forth in the attached Appendix. IT IS FURTHER ORDERED that to the extent specified herein, RM-3788 IS GRANTED, and in all other respects it IS DENIED. IT IS FURTHER ORDERED that this proceeding IS TERMINATED. This

action is taken pursuant to authority contained in Sections 4(i) and 303 of the Communications Act of 1934, as amended. In accordance with the Paperwork Reduction Act of 1980 (Public Law 96-511, December 11, 1980), the Commission will forward a copy of the final rules herein promulgated to the Associate Director for Information and Regulatory Affairs of the Office of Management and Budget. Further information on this matter may be obtained by contacting: Steve Lett, (202) 632-4964, Private Radio Bureau, Federal Communications Commission, Washington, DC 20554.

FEDERAL COMMUNICATIONS COMMISSION

William J. Tricarico
Secretary

APPENDIX

Part 97 of the Commission's Rules and Regulations, 47 CFR Part 97, is amended as follows:

1. In Section 97.7, paragraph (e) is revised to read as follows:

§ 97.7 Privileges of operator licenses.

* * * * *

(e) Novice Class. Radiotelegraphy in the frequency bands 3700-3750 kHz, 7100-7150 kHz (7050-7075 kHz when the terrestrial station location is not within Region 2), 21,100-21,200 kHz, and 28,100-28,200 kHz, using only type A1 emission and using only the international Morse code.

2. Section 97.69 is revised to read as follows:

§ 97.69 Digital communications.

Subject to the special conditions contained in paragraphs (a), (b) and (c) below, an amateur radio communication may include digital codes which represent alphanumeric characters, analogue measurements or other information. These digital codes may be used for such communications as (but not limited to) radio teleprinter, voice, facsimile, television, communications to control amateur radio stations, models and other objects, transference of computer programs or direct computer-to-computer communications, and communications in various types of data networks (including so-called "packet switching" systems); provided that such digital codes are not intended to obscure the meaning of, but are only to facilitate, the communications, and further provided that such operation is carried out in accordance with other regulations set forth in this part. (For purposes of this section, the sending speed (signaling rate), in baud, is defined as the reciprocal of the shortest (signaling) time interval (in seconds) that occurs during a transmission, where each time interval is the period between changes of transmitter state (including changes in emission amplitude, frequency, phase, or combination of these, as authorized).)

(a) Use of the International Telegraphic Alphabet No. 2 (Baudot code) is subject to the following requirements:

(1) Transmission shall consist of a single channel, five unit (start-stop) teleprinter code conforming to the International Telegraphic Alphabet No. 2 with respect to all letters and numerals (including the slant sign or fraction bar); however, in the "figures" positions not utilized for numerals, special signals may be employed for the remote control of receiving printers, or for other purposes indicated in this section.

(2) The sending speed shall not exceed 100 words per minute (75 baud).

(3) When frequency (or phase) shift keying (type F1 emission) is utilized, the deviation from the mark signal to the space signal, or from the space signal to the mark signal, shall be less than 900 hertz.

(4) When audio frequency shift keying (type A2 or F2 emissions) is utilized, the highest fundamental modulating frequency shall not exceed 3000 hertz, and the difference between the modulating audio frequency for the mark signal and that for the space signal shall be less than 900 hertz.

(b) Use of the American Standard Code for Information Interchange (ASCII) is subject to the following requirements:

(1) The code shall conform to the American Standard Code for Information Interchange as defined in American National Standards Institute (ANSI) Standard X3.4-1968.

(2) F1 emission shall be utilized on those frequencies between 3.5 and 29 MHz where its use is permitted; and the sending speed shall not exceed 300 baud.

(3) F1, F2 and A2 emissions may be utilized on those frequencies above 28 MHz where their use is permitted; and the sending speed shall not exceed the following:

(i) 1200 baud on frequencies between 28 and 50 MHz;

(ii) 19.6 kilobaud on frequencies between 50 and 220 MHz;

(iii) 56 kilobaud on frequencies above 220 MHz.

(4) A1 emission may be used for ASCII where F1 is permitted; and the sending speed shall not exceed that specified for other ASCII coded emissions on the same frequency.

(c) In addition to the above provisions, the use of any digital code is permitted on amateur frequencies above 50 MHz, except those on which only A1 emission is permitted, subject to the following requirements:

(1) Communications using such digital codes are authorized for domestic operation only (communications between points within areas where radio services are regulated by the U.S. Federal Communications Commission), except when special arrangements have been made between the United States and the administration of any other country concerned.

(2) The bandwidth of an emission from a station using such digital codes shall not exceed the following (where for this purpose the bandwidth is defined as the width of the frequency band, outside of which the mean power of any emission is attenuated by at least 26 decibels below the mean power of the total emission; a 3 kHz sampling bandwidth being used by the FCC in making this determination):

(i) 20 kHz on frequencies between 50 and 220 MHz;

(ii) 100 kHz on frequencies between 220 and 1215 MHz;

(iii) On frequencies above 1215 MHz any bandwidth may be used provided that the emission is in accordance with §97.63(b) and §97.73(c).

(3) A description of the digital code and the modulation technique shall be included in the station log during all periods of use and shall be provided to the Commission on request.

(4) When deemed necessary by an Engineer-in-Charge of a Commission field facility to assure compliance with the rules of this part, a station licensee shall:

(i) Cease the transmission of digital codes authorized under this paragraph.

(ii) Restrict the transmission of digital codes authorized under this paragraph to the extent instructed.

(iii) Maintain a record, convertible to the original information (voice, text, image, etc.), of all coded communications transmitted under authority of this paragraph.

THE DEAF AND THE TTY

Barry Strassler, Executive Director
Telecommunications for the Deaf, Inc.
814 Thayer Avenue
Silver Spring, MD 20910
301-589-3006 (Voice/TTY)

A Deafened Radio Amateur

By a coincidence, just a day after I started to take Morse Code lessons from Paul Rinaldo along with Nan Sanders, I received a TTY call from a deaf person in Georgia.

The caller was inquiring on behalf of his acquaintance, a ham who was rapidly losing his hearing. This ham was very depressed about his deafened condition, and the prospect of having to give up his ham radio hobby. So this deaf guy tried to cheer him up and felt that he could get some answers after talking to me.

I told him what a coincidence it was because I was just learning to become a ham. I also explained that there was much more to ham radio than using voice, as there are cw, RTTY, ATV, slow-scan TV, and facsimile means of communicating over the air. He was rather shocked but pleasantly so about it.

He said that he read somewhere in a publication about a deaf ham. But he could not recall the title or the date and asked me to verify it. I told him that I had not seen such an article recently but that I knew of a deaf RTTY ham in California, but that was years ago.

He said that he was going to show the hard copy of the TTY conversation we had to this ham in hopes of cheering him up. In closing, I mentioned that when I get my license, I hope to be able to chat with him on the air.

This brings to mind the question, "are there any deaf hams around?" I would think so. Knowing that there are deaf people in skilled fields and professions, I am sure that there are some. Perhaps they need to be ferreted out.

If any one of you readers know of deaf and deafened hams, please drop me a line. Maybe we can get something started.

Louisville Computer Clubs?

Would like to contact computer user clubs in Louisville, KY area. Do you know of any? If so please forward their address. Thanks. - W.C. Gaines, 1814 Lafontenay Ct, Anchorage, KY 40223.

Big Blue Packets

I pick up my micro tomorrow (IBM PC) and wish to go RTTY/packet on ham and/or Air Force MARS. - Curt Heuberger, K1CH, 51 Maynard Ave, Seekonk, MA 02771.

For Sale

C1PMF OSI computer, 32k memory, RS-232 in, TTL out, 25 disks, w/OSI op sys & Aardvark Bexec* + Maxipros w/p. All data. $800. - John Hyland, 914 Timber La, Vienna, VA 22180.

Newsletter Exchange

We are now exchanging newsletters with the Southern California Amateur Radio Computer Club. They meet on the 4th Sunday of each month at 1:30 P.M. with talk-in on 144.76/145.36 MHz. The SCARCC net meets on the same frequencies at 7 P.M. on Tuesdays. For information, SCARCC president Joe Feldstein, KA6BTM, can be reached on 714-527-8200. Or, write SCARCC, 962 Cheyenne St, Costa Mesa, CA 92626. Their newsletter is called Ham Bytes.

We are also receiving a new newsletter called SLAPR Protocol from the St. Louis Area Packet Radio Club and are very pleased to see rapid growth in packet radio there. If you're in the area, call Pete Eaton, WB9FLW, 618-288-5432. Or write SLAPR, 1309 Gloucester Dr, Edwardsville, IL 62025.

AMRAD — Amateur Radio Research and Development Corporation

Membership Application/Renewal

Mail to: Dr. William P. Pala, WB4NFB
5829 Parakeet Drive
Burke, VA 22015

See reverse for overseas mailing rates.

	Annual	Life
Dues: Regular	$15	$180
2nd in family same adr	8	96
Full-time student	5	-

Please make checks payable to AMRAD.

Name_____
Ham Call_____ Home Phone( )_____

Address_____
City,
State/Prov_____ ZIP/PC_____

Class License_____ ☐ARRL Member

Interests:
☐Packet Radio ☐Spread Spectrum
☐RTTY ☐Deaf TTY

Computer model_____
Microprocessor type_____

I agree to support the purposes of the Corporation.

*Signature*_____

The Amateur Radio Research and Development Corporation (AMRAD) is a worldwide club of over 500 amateur radio and computer experimenters. It is incorporated in Virginia and is recognized by the U.S. Internal Revenue Service as a tax-exempt scientific and educational organization.

The purposes of AMRAD are to: develop skills and knowledge in radio and electronic technology; advocate design of experimental equipment and techniques; promote basic and applied research; organize technical forums and symposiums; collect and disseminate technical information; and, provide experimental repeaters.

Meetings are on the 1st Monday of each month at 7:30 P.M. at the Patrick Henry Branch Library, 101 Maple Ave E, Vienna, VA. If the first month is a holiday, an alternate date will be announced in the newsletter. Except for the annual meeting in December, meetings are normally reserved for technical talks - not business.

WD4IWG/R is an open repeater for fm voice and digital communications, especially for experimental modes. It is located at Tyson's Corner, McLean, VA. It features semi-private autopatch available to licensed members. Frequencies are: 147.81 MHz in, 147.21 MHz out. The repeater director is Jeff Brennan, WB4WLW.

WB4JFI/R is a 1200-baud half-duplex packet repeater in Falls Church, VA and may be accessed via WD4IWG/R frequencies.

WB5MMB/R is a 1200-baud simplex packet radio repeater which operates on 147.585 MHz from Vienna, VA.

The AMRAD CBBS, 703-734-1387, is operated by Terry Fox, WB4JFI. The system accepts 110, 300, 450 and 600-baud ASCII, Bell 103.

Handicapped Education Exchange, 301-593-7033, is operated by Dick Barth, W3HWN. HEX accepts 110/300-baud ASCII and Baudot deaf TTY/TDD calls.

AMRAD is affiliated with the American Radio Relay League (ARRL), Foundation for Amateur Radio (FAR), Northern Virginia Radio Council (NOVARC) and the Mid Atlantic Repeater Council (T-MARC).

The AMRAD Newsletter is mailed monthly to members and other clubs on an exchange basis. Technical articles, product announcements, news items, and other copy relating to amateur radio and computing are welcome. Honorariums at a rate of $15 per printed page ($20 maximum per author per issue) are paid for original material accepted. Classified ads are free to members. Commercial ad inquiries are invited. The editor reserves the right to reject or edit any portions of the copy. Items should be mailed by the 8th of the preceeding month to Paul Rinaldo, W4RI, 1524 Springvale Ave, McLean, VA 22101. Full permission for reprinting or quoting items is granted provided that credit is given to both the author and the newsletter. Miling to U.S. and possessions is by 3rd Class bulk mail. Canadian and Mexican addresses add US$2 for postage. Overseas readers add US$8 for air mail or US$2.30 for surface.

AMRAD officers for 1982 are:

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David W. Borden, K8MMO	703-450-5284	Alternate
Jeffrey Brennan, WB4WLW	703-354-8541	Director Repeater Trustee
Robert E. Bruninga, WB4APR		VP, Asia
Terry L. Fox, WB4JFI	703-356-8334	Director Vice President CBBS Sysop
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Our CompuServe/Micronet number is [72345,1050], and our Source identity is TCA182.

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